

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-228852
 (43)Date of publication of application : 15.08.2000

(51)Int.Cl.

H02K 19/22
 H02K 3/24
 H02K 3/28

(21)Application number : 11-202071
 (22)Date of filing : 15.07.1999

(71)Applicant : DENSO CORP
 (72)Inventor : NAKAMURA SHIGENOBU
 TANIGUCHI MAKOTO
 SHIGA TSUTOMU

(30)Priority

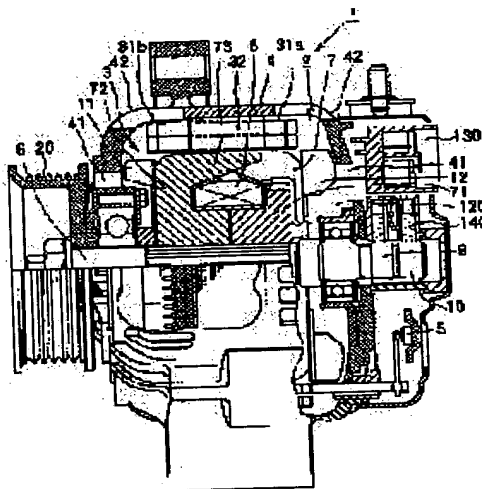
Priority number : 10344473 Priority date : 03.12.1998 Priority country : JP

(54) ALTERNATOR FOR VEHICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an alternator for a vehicle which can secure a high space factor and a cooling performance so as to achieve high-output with a small size, and is inexpensive.

SOLUTION: This alternator is provided with a rotor iron cores 71 and 72, having 2p magnetic poles and armature winding 31 constituting m phases of winding, and the number of slots of armature iron core 32 is $2pmn (\geq 2)$, and the number of conductors inserted into one slot is 2, and two conductors are arranged in one row in the radial direction within the slot, and the sections where the inner conductor within the k-th slot and the outer conductor within the $(k \pm mn)$ -th slot are connected with each other, being twisted in the radial direction in an optional position between the kth slot and the $(k \pm mn)$ -th slot at the coil end are provided by $2n (2p-1)$ places per phase, and the conductors stored in n pieces of plural adjacent slots are connected with one another, and one phases of the coils is made.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The rotor core which has the magnetic pole of $2p$ poles. The rotator which has a cooling fan in the shaft-orientations ends side of this rotor core. The armature winding which constitutes the coil of m phase. The armature core of the plurality holding this armature winding which carries out slot **. It is the coil end of a coil besides the aforementioned slot of the shaft-orientations both sides of this armature core. It is the AC generator for vehicles equipped with the above, and the number of the slots of the aforementioned armature core is $2pmn(s)$ ($n \geq 2$). Two conductors have aligned in one train in the direction of a path within the slot. the number of the conductors inserted in one slot -- 2 -- it is -- this -- The aforementioned coil and the portion which was alike, was twisted by radial in the arbitrary positions between the k -th slot and a ** ($k^{**}mn$) slot, and is connected set a conductor to the aforementioned coil end the outer layer side within a conductor and a ** ($k^{**}mn$) slot the inner layer side within the k -th slot. It is characterized by connecting the conductor contained by the n aforementioned slots which it is about [1] sufficient for and $2n(2p-1)$ part ***** and plurality adjoin, and forming the coil of one phase.

[Claim 2] the segment by which the conductor contained by the aforementioned slot was operated orthopedically -- a conductor constitutes -- having -- the aforementioned segment -- the AC generator for vehicles according to claim 1 characterized by forming a coil by connecting a conductor

[Claim 3] the aforementioned segment inserted in the k -th slot of the above, and a ** ($k^{**}mn$) slot -- the aforementioned segment by which the conductor was orthopedically operated by one side of the aforementioned coil end in the shape of a hairpin -- the AC generator for vehicles according to claim 2 characterized by arranging the turn section of a conductor and arranging a connection on another side of the aforementioned coil end

[Claim 4] the aforementioned segment -- the AC generator for vehicles according to claim 2 characterized by operating a conductor orthopedically in the shape of abbreviation for S characters, and arranging a connection in the both sides of the aforementioned coil end

[Claim 5] The aforementioned coil is an AC generator for vehicles according to claim 1 characterized by what was formed of the conductor which continues for every phase.

[Claim 6] The cross-section configuration of the conductor stored in the aforementioned slot is one AC generator for vehicles of the 5 publications from the claim 1 characterized by being $a > b$ if the length of a and a hoop direction is set to b for the radial length.

[Claim 7] the aforementioned slot -- the direction of a path -- abbreviation -- one AC generator for vehicles of the 6 publications from the claim 1 which has an parallel wall surface and is characterized by the cross section of the aforementioned electric conductor being the flat straight angle configuration where the aforementioned slot configuration was met

[Claim 8] A rotor core with p pairs of NS magnetic poles. The armature core which has the armature winding which constitutes the coil of m phase, and two or more slots holding the aforementioned armature winding. A conductor with the cross section of the abbreviation rectangle which is the AC generator for vehicles equipped with the above, and constitutes the aforementioned armature winding in each aforementioned slot rather than a hoop direction, as the direction of a path becomes long, it arranges to a inner layer and outer layer side -- having -- the above -- a conductor It has the inner conductor section located in the aforementioned slot, and the coil and the section which are prolonged out of the aforementioned slot from this inner conductor section. The aforementioned coil and the section of a conductor are connected. the above arranged at the different aforementioned slot -- The aforementioned coil connected in the said layers in by the side of a inner layer and an outer layer, and the direction length of a path of the section the above which made it shorter than the direction length of a path of the aforementioned inner conductor section, and was contained each by the n adjoining aforementioned slots [two] (natural number of $n \geq 2$) -- the series connection of the conductor is carried out, and the coil of one phase is formed and it is characterized by carrying out $2pmn$ individual

formation of the aforementioned slot

[Claim 9] The aforementioned coil connected in the said layers and the direction length of a path of the section are an AC generator for vehicles according to claim 8 characterized by being the abbreviation half of the direction length of a path of the aforementioned inner conductor section.

[Claim 10] The aforementioned coil and the section which are connected in the said layers are an AC generator for vehicles according to claim 8 or 9 characterized by bending the end side of the direction of a path at the other end side.

[Claim 11] The aforementioned coil and the section which are connected in the said layers are an AC generator for vehicles according to claim 8 or 9 characterized by being twisted so that the field which follows the hoop-direction side of the inner conductor section may turn to the direction of a path.

[Claim 12] the above which has the outgoing end of the coil of each aforementioned phase -- the above connected in a conductor and the said layers -- the claim 8 to which a number of the aforementioned slot of sum totals with which a conductor adjoins are characterized by being arranged within the limits of $n \times (2m+1)$ individual, or the AC generator for vehicles of any one publication of 11

[Claim 13] the above -- the segment by which the conductor was fabricated in the shape of abbreviation for S characters -- a conductor -- it is -- this segment -- the claim 8 characterized by connecting a conductor and forming the aforementioned coil, or the AC generator for vehicles of any one publication of 12

[Translation done.]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001] [The technical field to which invention belongs] this invention relates to the AC generator for vehicles.

[0002] [Description of the Prior Art] In recent years, the AC generator for vehicles (following AC dynamo) came to be asked more for the output supply from low-speed rotation by reduction of the idle rpm of a vehicle's engine as a cure against an environmental problem. Moreover, the demand output is also increasing by loading of environmental cure equipment which requires power. On the other hand, the miniaturization demand on the parts carried in an engine room for lightweight-izing for the improvement in mpg and reservation of vehicle room space has also become strong every year. And a cost reduction demand cannot be overemphasized.

[0003] In order to lower the resistance of the armature winding which is a coil which carries out induction of the power generation in a generator to meet these demands and to reduce loss, as shown in JP,63-194543,A, the coil cross section within a slot is fabricated in the shape of a straight angle, and there are some which are going to gather the space factor within a slot. However, since the coils of each phase (generally three phase circuit) interfere in the direction of a path, a coil end swells and it cannot respond [in / the coil end besides a slot / only at gathering the space factor within a slot] to a miniaturization demand.

[0004] then, two or more conductors fabricated in the shape of a hairpin in the international public presentation 92/No. 06527 official report -- an armature coil is constituted from a segment, and a coil is formed, without the coil and comrades interfering in the direction of a path mutually, consequently the coil technology corresponding to a miniaturization demand is proposed

[0005] [Problem(s) to be Solved by the Invention] However, even if it combines the technology of JP,63-194543,A and the international public presentation 92/No. 06527 official report, for a high increase in power, there is a cooling performance issue which lowers loss by the armature coil.

[0006] Generally in an AC dynamo, a cooling fan (12 11) is formed in the shaft-orientations ends of a rotor core (71 72), the aforementioned cooling fan rotates with rotation of a rotator (7), and it is the coil end (31a, 31b) of an armature about a cooling wind. The structure which sprays and cools an armature winding is taken.

[0007] Moreover, negative pressure was produced to the entrance-side space (120) because the aforementioned cooling fan rotates, from AC-dynamo back, fresh air was introduced into the interior and the rear side electrical part (5,130,140), the rotator coil (8), and the armature coil are cooled.

[0008] Therefore, if the cooling wind which the aforementioned fan sprayed on the armature coil does not fall out on the outside of an armature coil efficiently, it piles up around an armature coil (2 3), and new fresh air is not introduced into the interior of an AC dynamo, but it becomes the cause of a temperature rise. Although it is common to design the fan fully breathed out even if it increases the capacity of a cooling fan to solve this and the **** resistance of the cooling style is high, while such a fan is large-sized and it is contrary to a miniaturization demand, the new problem of noise increase is also produced for the AC dynamo further used to a high-speed rotation region.

[0009] the conductor from which a slot differs in the AC dynamo shown in the international public presentation 92/No. 06527 official report as shown in drawing 9 -- the conductor inserted in the same slot although the crevice (38) is secured in comrades -- since comrades have stuck and cannot secure a crevice at all -- this conductor -- in between, it could not ventilate but cooling of an armature coil end was inadequate

[0010] the shape of that is, these hairpins -- in the armature which inserted two or more conductors into one slot, the draft resistance (especially **** resistance) as about [that a conductor cannot fully be cooled] and an AC dynamo increased, when a fan's capacity was not increased, the inhalation air capacity itself decreased, and there was a problem

of also affecting cooling of other parts I see, such a problem will become more serious, as the number of turns per slot increase, if a pole ($2p$) increases.

[0011] On the other hand, in the international public presentation 92/No. 06527 official report, a conductor is arranged a conductor and outer layer side a inner layer side in one slot, a conductor is connected with a conductor one by one by turns an outer layer side the inner layer side within a different slot, and the composition of the coil wound twice with one phase is shown. However, in the passage section which connects the said layers (a inner layer, a inner layer or an outer layer, and outer layer), in order to prevent interference with the passage section and a coil end, after the passage section is further extended rather than the nose of cam of a coil end at a shaft-orientations edge side, it is prolonged and connected to the hoop direction. Therefore, the maximum height of the substantial shaft orientations of a coil end is determined by this passage section, and has become the prevention factor of a miniaturization of an AC dynamo.

[0012] That a performance [that it is small and high power] should be attained, this invention is a high space factor, and can secure a cooling performance, and aims at moreover offering a cheap AC dynamo.

[0013] Moreover, this invention sets it as other purposes for it to be small, to start and to offer an AC dynamo with a low rotational frequency cheaply.

[0014]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, in invention according to claim 1 The rotor core which has the magnetic pole of $2p$ poles, and the rotator which has a cooling fan in the shaft-orientations ends side of this rotor core, In the AC generator for vehicles equipped with the coil end of a coil out of the aforementioned slot of the shaft-orientations both sides of the armature winding which constitutes the coil of m phase, the armature core of the plurality holding this armature winding which carries out slot **, and this armature core The number of the slots of the aforementioned armature core is $2pmn(s)$ ($n \geq 2$), and the number of the conductors inserted in one slot is 2. Two conductors have aligned in one train in the direction of a path within the slot. this -- The aforementioned coil and the portion which was alike, was twisted by radial in the arbitrary positions between the k -th slot and a ** ($k**mn$) slot, and is connected set a conductor to the aforementioned coil end the outer layer side within a conductor and a ** ($k**mn$) slot the inner layer side within the k -th slot. It is characterized by connecting the conductor contained by the n aforementioned slots which it is about [1] sufficient for and $2n(2p-1)$ part ***** and plurality adjoin, and forming the coil of one phase.

[0015] thereby -- a coil -- and -- without it is alike, it sets and it interferes in all conductors -- a conductor -- since a crevice is formed in between, a cooling wind passes through this crevice since it is [that two conductors are only arranged in a slot at one train, and] even if a pole increases and the number of slots increases -- a coil and the conductor which comes out -- it is securable similarly between gaps, and by the above, it can secure a cooling performance and can enable improvement in an output although two conductors are arranged in the slot, in order [and] to satisfy desired output characteristics -- a conductor -- when three or more substantial numbers have been arranged by connection of a between, it can adjust

[0016] the segment by which the conductor contained by the aforementioned slot was operated orthopedically according to the claim 2 -- a conductor constitutes -- having -- the aforementioned segment -- it is characterized by forming a coil by connecting a conductor Insertion into the slot of a conductor is made easy by this, and a manufacture man day can be reduced.

[0017] the aforementioned segment which is inserted in the k -th slot of the above, and a ** ($k**mn$) slot according to the claim 3 -- the aforementioned segment by which the conductor was orthopedically operated by one side of the aforementioned coil end in the shape of a hairpin -- since it is characterized by arranging the turn section of a conductor and arranging a connection on another side of the aforementioned coil end and a joint can be concentrated on one side of a coil end, a junction man day can be reduced

[0018] according to a claim 4 -- the aforementioned segment -- it is orthopedically operated in the shape of abbreviation for S characters, and since the conductor is characterized by arranging a connection in the both sides of the aforementioned coil end, it can reduce the manufacture man day of the segment itself

[0019] since it is characterized by what the aforementioned coil was formed for of the conductor which continues for every phase according to the claim 5 -- a segment -- the junction man day between each segment can be lost to the case where a conductor is used

[0020] According to the claim 6, since the cross-section configuration of the conductor stored in the aforementioned slot is characterized by being a $>b$ if the length of a and a hoop direction is set to b for the radial length, to the cooling wind which passes through a coil and inside and flows in the direction of a path, it secures the ventilation flue cross section and can improve a cooling performance.

[0021] according to a claim 7 -- the aforementioned slot -- the direction of a path -- abbreviation -- it has an parallel wall surface, and since it is characterized by the cross section of the aforementioned electric conductor being the

straight angle configuration where the aforementioned slot configuration was met, high space factor-ization is made easy

[0022] In the AC generator for vehicles equipped with a rotor core with p pairs of NS magnetic poles, the armature winding which constitutes the coil of m phase, and the armature core which has two or more slots holding an armature winding in invention according to claim 8 The conductor which has the cross section of the abbreviation rectangle which constitutes a coil in each slot is arranged at a inner layer and outer layer side, as the direction of a path becomes long rather than a hoop direction. a conductor It has the inner conductor section located in a slot, and the coil and the section which are prolonged out of a slot from this inner conductor section. The coil which the coil and the section of a conductor which have been arranged at a different slot are connected, and is connected in the said layers in by the side of a inner layer and an outer layer, and the direction length of a path of the section It is made shorter than the direction length of a path of the inner conductor section, the conductor contained each two is connected to n adjoining slots (natural number of $n \geq 2$), the coil of one phase is formed, and it is characterized by carrying out $2pmn$ individual formation of the slot.

[0023] Since according to this two conductors are arranged into each slot and the conductor within two or more adjoining slots is connected, the number of turns on appearance ($2n$ turn / phase) increases, and a standup rotational frequency can be made low. Moreover, since the coil connected in the said layers and the direction length of a path of the section are made shorter than the direction length of a path of the inner conductor section, it becomes unnecessary to be able to prevent interference of the direction of a path between two or more connections containing this layer connection, therefore to make this layer connection able to project to a shaft-orientations edge side further rather than the nose of cam of a different layer connection, and the real height of a coil end can be stopped low. Therefore, it is small, and starts and an AC dynamo with a low rotational frequency can be realized.

[0024] Two or more connections containing this layer connection can be arranged in piles in the direction of a path by making into the abbreviation half of the direction length of a path of the inner conductor section the coil connected in the said layers, and the direction length of a path of the section like invention according to claim 9.

[0025] The direction length of a path is made as for the coil and the section which are connected in the said layers by bending the end side of the coil connected in the said layers, and the direction of a path of the section to an other end side like invention according to claim 10 to abbreviation half, with the cross section of a conductor held.

[0026] The coil and the section which are connected in the said layers by twisting so that the field which follows the hoop-direction side of the inner conductor section like invention according to claim 11 in the coil and the section which are connected in the said layers may turn to the direction of a path can shorten the direction length of a path, with the cross section of a conductor held.

[0027] The conductor of a different configuration from the conductor of the shape of standard form connected in different layers like invention according to claim 12, Namely, when an adjoining number of a slot of sum totals carry out intensive arrangement of the conductor connected by the conductor and the said layers which have the outgoing end of the coil of each phase within the limits of $n \times (2m+1)$ individual Mixture attachment prevention with a standard form-like conductor and an anomaly-like conductor can be made easy, as a result it can tie to reduction of a manufacturing cost.

[0028] the segment by which the conductor was fabricated in invention according to claim 13 in the shape of abbreviation for S characters -- a conductor -- it is -- this segment -- it is characterized by connecting a conductor and forming a coil Thereby, manufacture of a conductor and insertion into a slot are made easy, and a manufacturing cost can be reduced.

[0029] [Embodiments of the Invention] (The first operation form) Drawing 4 shows the first operation form from drawing 1, and the example of $2p=12$, $m=3$ (X phase, Y phase, Z phase), and $n=3$ is shown. In addition, n can be made or more into two and three or more are desirable.

[0030] It is explanatory drawing [concerning / drawing 2 -6 / the coil specification of this invention] concerning [drawing 1] the cross section of an AC dynamo.

[0031] The number of the slots prepared in an armature core (32) is set to 108, and a slot pitch is set to 18. that is, the inside of the k -th slot -- the outside of a conductor and a $(k+9)$ slot -- it is connected so that a conductor may transfer to radial in the arbitrary positions between the k -th slot and a $(k+9)$ slot However $(k+9) > 108$, The case of 108, and $(k-9)$ in the case of <1 , the 100th slot, the 1st and the 101st slot, the 2nd slot, and the 107th slot, the 8th slot and the 108th slot, and the 9th slot are connected.

[0032] X phase is extracted to drawing 2 and the coil method is explained to it.

[0033] Drawing 3 is some (conductor inserted in the 1st slot and the 10th slot) perspective diagrams of the conductor which constitutes the coil specification of drawing 2. It inserts so that two coils which come out of the conductor

orthopedically operated in the shape of [which is shown in drawing 3] a crank from one slot, and the direction of bending of the section may become a retrose mutually. the coil specification view of drawing 2 -- an outside -- a conductor -- a solid line and the inside -- a wavy line describes a conductor A number shows the number of a slot. [0034] the outside of the 10th slot -- one skew section (31a11) of a conductor -- the inside of the 1st slot -- a conductor transfers and leads to radial by connecting by soldering, welding, etc. in one skew section (31a12) of a conductor, a coil, and the section A side edge section (31a15) the same -- the outside of the 10th slot -- a conductor transfers and leads to radial because one skew section inside the 19th slot (31b12) connects [the skew section (31b11) of another side of a conductor] by soldering, welding, etc. in a coil and the section B side edge section (31b15) further -- the inside of the 19th slot -- the other-end section of a conductor -- the outside of the 28th slot -- it connects by soldering, welding, etc. by edge [of a conductor], coil, and Section A side (not shown) Insertion connection is made one by one with the same rule. however, the outside of the 100th slot -- the outside of a conductor (31a13) and the 1st slot -- you have to connect a conductor (31a14) by coil and Section A side (31a16) thus, the conductor of the $(1+9k)$ slot by which insertion connection was made -- a group serves as the shape of one loop, and will wind an armature armature core (32) twice That is, the coil of 2 turns / slot is formed. this conductor -- a group is one coil x1 which constitutes the coil of X phase

[0035] here -- this conductor -- when a group is made into one unit, one portion (31a16) to which the portion which ties the conductor of the inside and an outside to one unit ties 22 places (31a15, 31b15 grade) and outsides will be made

[0036] The coil group which the coil group inserted in a slot [being same $(2+9k)$] is coil x2 which constitutes the coil of X phase, and is inserted in the slot of $(3+9k)$ is the coil x3 which constitutes the coil of X phase.

[0037] If x2 is connected with these coils x1 as shown in (31a18), and it connects as it is indicated in x3 (31a17) as x2, x1, x2, and x3 will become possible [connecting in series and constituting the coil of 6 turns / phase].

[0038] That is, three portions to which the portion which connects the conductor of the inside and an outside into 1 phase connects 66 places and outsides will be made.

[0039] the case where these carry out until [general] extension of p, m, and the n -- an outside -- a conductor and the inside -- the portion with which a conductor is transferred and connected -- 1 -- fairly -- sufficient -- $2n(2p-1)$ part and an outside -- a conductor -- the portion with which comrades are connected -- 1 -- it will be fairly sufficient and n places will exist

[0040] x1, x2, and x3 will obtain Z phase coil, if the coils z1, z2, and z3 with which the phase shifted 240 degrees electrically will be formed if similarly $(4+9k)$ the conductor inserted in the slot of $(5+9k)$ and $(6+9k)$ is connected with the same rule as the above, and these are connected in series.

[0041] The coils y1, y2, and y3 with which the phase shifted 120 degrees electrically when similarly $(7+9k)$ the conductor inserted in the slot of $(8+9k)$ and $(9+9k)$ was connected with the same rule as the above are formed, and x1, x2, and x3 will obtain Y phase coil, if these are connected in series.

[0042] Thus, the configuration which developed the coil and the section of an armature which were made is shown in drawing 4.

[0043] the conductor which came out of each slot and which adjoined -- between -- a crevice -- it is -- therefore, all conductors -- since a cooling wind passes through the crevice between between uniformly, a conductor can be cooled efficiently

[0044] Furthermore, although the aforementioned crevice also becomes an outlet of the cooling style, since the draft resistance of this portion does not increase and the cooling nature of the electrical part which does not need to enlarge the fan itself, can take in sufficient fresh air for the interior of an AC dynamo, and is arranged at a rotator coil or a rear side is not spoiled, it is small high power and a reliable AC dynamo can be offered.

[0045] in addition -- the example indicated here -- an outside -- a conductor and the inside -- the same effect can be acquired even if it replaces a conductor in this case, the inside of the 100th slot -- the inside of a conductor and the 1st slot -- a conductor -- comrades will be connected

[0046] Moreover, although the number p of pole pairs, a source resultant pulse number m, and Division n present an effect with the same said of the arbitrary natural numbers, the more the number p of pole pairs and Division n are large, the more the effect will become big.

(The second operation form) The second operation form is shown in drawing 5 and 6. drawing 5 and the segment from which 6 constitutes the coil specification of drawing 2 -- they are some perspective diagrams of a conductor It is the example of thing mist beam $2p=12$, $m=3$, and $n=3$ shown here.

[0047] connecting on both sides of a coil end in the first operation form -- receiving -- the second operation form -- the conductor by the side of a coil and Section A -- a coil is formed only by connection of comrades concrete -- the inside of the k-th slot -- the outside of a conductor and a $(k+9)$ slot -- a conductor -- hairpin-like continuation -- a connection place can be reduced in the abbreviation half of the 1st example with constituting from a conductor

Furthermore, since this hairpin section does not have the object for ** which connects a conductor, it is not necessary to remove a coat, therefore insulating processing also becomes unnecessary, and reduction of a large man day is possible for it.

[0048] After operating a conductor orthopedically in the shape of a hairpin first (drawing 5), it opens by the desired slot pitch in the direction of an arrow, and what operated the other end of each other orthopedically in the shape of a crank to opposite direction further (drawing 6) is inserted in a slot from the inner circumference side of an armature core.

[0049] The portion equivalent to the radial transition section (31a15) shown in the first operation form here is the flection (31a25) of a hairpin, and since, as for this portion, the conductor has fogged the coat, the coil and A side is insulating processing needlessness.

[0050] The connection rule by the side of a coil and Section B is as having indicated in the example 1.

[0051] Thus, the coil and the section of an armature which were obtained can also secure sufficient crevice to pass a cooling wind for the same coil end as drawing 4 by *****'s.

[0052] In addition, while it has been straight, after inserting in a slot from the shaft orientations of an armature core (32), without operating the other end of a hairpin orthopedically in the shape of a crank beforehand like drawing 6 , it may bend by the desired pitch and you may operate orthopedically.

(The third operation form) the first and second operation form -- a segment -- although the conductor was used, you may form the coil of each phase like the third operation form shown in drawing 7 using a successive line The connection man day between segments is lost and a manufacture man day can be reduced.

(The fourth operation form) the time of drawing 8 showing the fourth operation form and setting a and hoop-direction length to b for the radial length of a conductor -- a > b considering as a length relation -- it is -- the round shape of the same cross section -- a conductor and an abbreviation square -- compared with the case where a conductor is used, it passes through a coil and inside and flows in the direction of a path -- it receives in the style of cooling, the ventilation flue cross section is secured, and a cooling performance Moreover, when an n value is made to increase, the length of a hoop direction can be reduced sharply and the bore of an armature core and outer-diameter length can be stopped. jamming can carry out small [of the own physique of an AC dynamo] -- it comes out

[0053] Moreover, as shown in drawing 8 , a slot wall surface is good also as parallel to the direction of a path. In this case, since the cross-section configuration of an electric conductor is a straight angle configuration where the slot configuration was met, a raise in a space factor is easy. Since a position becomes easy to be decided, it becomes easy to insert the insertion process to the slot of a conductor.

(The fifth operation form) Drawing 15 shows the fifth operation form from drawing 10 , and it is explanatory drawing [concerning / drawing 11 -15 / an armature] concerning [drawing 10] the cross section of an AC dynamo. This operation form is what changed the configuration of a conductor and arrangement which are connected by the conductor and the said layers which have the outgoing end of the coil of each phase, and attained the miniaturization of the shaft-orientations size of an AC dynamo. the AC dynamo of this example -- magnetic pole pair p=6 (number of magnetic poles = 12), and several phases -- several [of the slot by which the conductor which constitutes the coil of m = 3 (X phase, Y phase, Z phase) or 1 phase adjoins, and is arranged] -- it is n= 3

[0054] As shown in drawing 10 , AC dynamo 1 consists of rectifier 5 grades which the output line of the coil 31 of an armature 3 is connected with the frame 4 which supports the field rotator 2 which works as a field, the armature 3 which generates electromotive force by the rotation magnetic flux from this rotator 2, and a rotator 2 and an armature 3, and change ac power into a direct current.

[0055] The rotator 2 is equipped with the Laon Dell type magnetic pole iron cores (rotor core) 71 and 72, a field coil 8, and the slip rings 9 and 10. The disk section was prolonged toward the method of the outside of the direction of a path from the **** boss section with a group at the shaft 6, and, as for the Laon Dell type magnetic pole iron cores 71 and 72, the six presser-foot-stitch-tongue-like magnetic pole sections 73 are prolonged in shaft orientations from the disk section, respectively. Moreover, the field coil 8 with which an exciting current flows through the slip rings 9 and 10 is arranged so that it may be enclosed by the magnetic pole iron cores 71 and 72.

[0056] Rotating a rotator 2 united with a shaft 6, a shaft 6 is connected with a pulley 20 and a rotation drive is carried out through a belt with the engine for a run (not shown) carried in the automobile. In addition, cooling fans 11 and 12 are being fixed by proper meanses, such as welding and a caulking, and cooling fans 11 and 12 rotate in the shaft-orientations both-sides side of each magnetic pole iron cores 71 and 72 united with a rotator 2, and make it produce the flow of the cooling style.

[0057] the shaft-orientations ends side of a frame 4 -- the inhalation of air for inhalation of the cooling style -- the hole 41 is formed Moreover, the exhaust hole 42 for discharge of the cooling style is formed in the periphery portion which countered the first coil of an armature winding 31, 31a, the second coil, and 31b at the frame 4, respectively.

[0058] As shown in drawing 11, two or more slots 35 are formed in the armature core 32 so that the armature winding 31 of a polyphase can be held. With this operation form, corresponding to the number of magnetic poles of a rotor 2 (12 very), 108 slots 35 are arranged at equal intervals at the hoop direction so that the armature winding 31 of a three phase circuit may be contained. The armature winding 31 with which the slot 35 of an armature core 32 was equipped can be grasped as 1 one electric conductor, two electric conductors which consist of copper are held into each of a slot 35, and it has insulated with the insulator 34 between two electric conductors and the wall of a slot 35. In addition, it is the flat rectangle whose cross section of an electric conductor is $a > b$ when a and the slot-width direction (hoop direction) length are set to b for the slot depth direction (direction of path) length, and two electric conductors are arranged in the slot depth direction at one train.

[0059] Next, the configuration of coil specification and a conductor, arrangement, etc. are explained in full detail in drawing 12 -15. Drawing 12 is the coil specification view which extracted only one phase among the armature windings 31 of a three phase circuit, and shows the conductor for the conductor with the dashed line the solid line and inner layer side the outer layer side. Moreover, the number in drawing 12 shows the number of a slot, and, in the number of slots, 108 pieces and NS pole pitch correspond to nine slots.

[0060] the coil specification of this operation form -- the 1st operation form -- the same -- the conductor of a $** (1+9k)$ slot -- a group serves as the shape of one loop, an armature core 32 is wound twice, and the coil of 2 turns / slot is formed and the conductor of a $** (1+9k)$ slot -- a group and the conductor of a $** (2+9k)$ slot -- a group and the conductor of a $** (3+9k)$ slot -- the series connection of the group is carried out and the coil of 6 turns / phase is constituted

[0061] Drawing 13 is some (conductor inserted in the 1st slot and the 10th slot) perspective diagrams of the conductor which constitutes the coil specification of drawing 12. the segment by which the conductor was bent in the shape of abbreviation for S characters -- it is a conductor and this conductor has the second coil, and 31a and 31b for a start which is prolonged out of a slot 35 from the both sides of inner conductor section 31c contained in a slot 35, and this inner conductor section 31c. Moreover, for a start, the second coil, and 31a and 31b had the skew section prolonged from inner conductor section 31c, and have connected the conductor from a different slot 35 in the point of this skew section. In addition, it is arranged so that the two skew sections prolonged on both sides may become a retrose from inner conductor section 31c mutually, and so that a hoop direction with the reverse skew section of a conductor may be turned to a skew section [of a conductor], and outer layer side a inner layer side.

[0062] And one skew section 31a12 of a conductor is joined to one skew section 31a11 of a conductor by soldering, welding, etc. in the point 31a15 of the first coil and 31a the inner layer side of the 1st slot the outer layer side of the 10th slot. Moreover, one skew section 31b12 of a conductor is joined to the skew section 31b11 of another side of a conductor by soldering, welding, etc. by the point 31b15 of the second coil and 31b the inner layer side of the 19th slot the outer layer side of the 10th slot.

[0063] similarly, one skew section 31a10 of a conductor joins to one skew section of a conductor the outer layer side of the 19th slot the inner layer side of the 10th slot -- having -- the inner layer side of the 10th slot -- the skew section 31b10 of another side of a conductor -- the outer layer of the 1st slot -- it is joined to one skew section of a conductor. The coil used as a basic pattern is formed by repeating the above junction.

[0064] the point 31a16 by the side of the first coil from the 100th slot which a coil reverses in drawing 12 on the other hand, and the 1st slot, and 31a -- an outer layer side -- a conductor -- junction of comrades -- it is -- the same -- the each first coil and 31a side of the 101st slot, the 2nd slot, and the 102nd slot and the 3rd slot -- an outer layer side -- a conductor -- it becomes junction of comrades

[0065] Drawing 14 is the perspective diagram of the conductor arranged at this 100th slot to reverse and 1st slot. The outer layer side inserted in the 100th slot the first coil of a conductor and the 31a side skew section 31a13. An outer layer side is deleted by cutting etc. and has direction length of path c of the half of direction length of path a of inner conductor section 31c in a inner layer side. The outer layer side inserted in the 1st slot the first coil of a conductor and the 31a side skew section 31a14. It has direction length of path c of the half of direction length of path a of inner conductor section 31c in an outer layer side, and these skew sections 31a13 and 31a14 are piled up in the direction of a path in the point 31a16, and are joined by soldering, welding, etc. Moreover, a conductor is the same composition as a conductor the outer layer side arranged at the 100th slot and the 1st slot each outer layer side of the 101st slot, the 2nd slot, and the 102nd slot and the 3rd slot. In addition, you may make reverse the direction position of a path of half direction length of path c.

[0066] furthermore, it is shown in drawing 12 -- as -- the first coil side [of the 91st slot and the 101st slot], 31a side, and first coil side of the 92nd slot and the 102nd slot, and the 31a side -- each inner layer side -- a conductor -- comrades are joined. Moreover, a conductor has outgoing end 31aa' and 31aa in the first coil and 31a side the inner layer side of the 93rd slot and the 100th slot.

[0067] the perspective diagram of the conductor in which drawing 15 has conductor [to which inner layers are joined] and outgoing end 31aa, and 31aa' -- it is -- three conductors -- the state where the series connection of the group was carried out is shown The inner layer side inserted in the 91st slot the first coil of a conductor and the 31a side skew section 31a19 Having direction length of path c of the half of direction length of path a of inner conductor section 31c in a inner layer side, the first coil of a conductor and the 31a side skew section 31a20 have direction length of path c of the half of direction length of path a of inner conductor section 31c in an outer layer side the inner layer side inserted in the 101st slot. And these skew sections 31a19 and 31a20 are piled up in the direction of a path in the point 31a18, and are joined by soldering, welding, etc. Moreover, a conductor is the same composition as a conductor the inner layer side arranged at the 91st slot and the 101st slot each inner layer side of the 92nd slot and the 102nd slot.

[0068] the inner layer side inserted in the 93rd slot -- the first coil of a conductor, and the 31a side skew section 31a21 -- direction length of path c of the half of direction length of path a of inner conductor section 31c -- a inner layer side -- having -- and direction length of path c -- being still fixed -- a point 31a17 and 31a18 -- shaft orientations (right of drawing 1) -- projection -- it has outgoing end 31aa' the bottom moreover, the inner layer side inserted in the 100th slot -- the first coil of a conductor, and the 31a side skew section 31a22 -- direction length of path c of the half of direction length of path a of inner conductor section 31c -- an outer layer side -- having -- and direction length of path c -- being still fixed -- a point 31a17 and 31a18 -- shaft orientations (right of drawing 1) -- projection -- it has outgoing end 31aa the bottom

[0069] several phases -- $m = 3$ and the conductor by which a series connection is carried out -- with this operation form which are $n = 3$ groups, it concentrates on all 21 slots which adjoin in succession from the 91st slot to the 3rd slot in drawing 12 , and the conductor which made direction length of path c of the first coil and the 31a side skew section the half of direction length of path a of inner conductor section 31c is arranged As a general formula, intensive arrangement is carried out at $nx(2m+1)$ slot.

[0070] as mentioned above, the conductor within three slots which arrange two conductors into each slot 35, and adjoin it -- since the series connection of the group is carried out, the number of turns on appearance increases with 6 turns / phase, and can make a standup rotational frequency low Moreover, since direction length of path c of the coil end connected in the said layers is made into the half of direction length of path a of inner conductor section 31c, even if it arranges in piles the coil end to which the said layers (a inner layer, a inner layer or an outer layer, and outer layer) are joined in the direction of a path, it does not interfere. Therefore, although the passage section further extended to the shaft-orientations edge side was more nearly required than the nose of cam of other coil ends in order to prevent interference with other coil ends when connecting the said layers conventionally, according to this operation form, such the passage section is unnecessary. Therefore, since the real height of a coil end can be made low, a miniaturization becomes possible.

[0071] By the way, in the AC dynamo which crosses like before and has the section, since the mechanical strength of a conductor falls and vibration of the passage section becomes large when a conductor is flattened further, expansion of the distance for interference prevention with a frame 4 or other coil ends is needed, and it is contrary to the miniaturization of an AC dynamo. Moreover, for the oscillating fall of the passage section, separately, if fixing processing etc. is performed, since a man day will increase, a manufacturing cost rises. on the other hand, the conductor by which a series connection is carried out in order to start further and to make a rotational frequency low with this operation form -- since there is no passage section of the said layers even if a conductor becomes still flatter in connection with increase and it about the number n of groups, the oscillating cure (interference prevention and fixing processing) of the passage section becomes unnecessary, and the effect of a miniaturization or cost reduction can be acquired

[0072] Moreover, the conductor of a different configuration from the conductor of the shape of standard form connected in different layers, Namely, the conductor which has outgoing end 31aa of the coil of each phase, and 31aa' and the conductor connected in the said layers (direction length of path c of a coil end) When an adjoining number of a slot of sum totals arrange the conductor made into the half of direction length of path a of inner conductor section 31c within the limits of $nx(2m+1)$ individual, mixture attachment prevention with a standard form-like conductor and an anomaly-like conductor can be made easy, as a result it can tie to reduction of a manufacturing cost.

(The sixth operation gestalt) Drawing 16 shows the sixth operation gestalt and the concrete composition for making small the direction length of a path of the coil end connected in the said layers differs from the fifth operation gestalt.

[0073] Drawing 16 the outer layer side which shows the conductor arranged at the 100th slot and the 1st slot, and was inserted in the 100th slot the first coil of a conductor and the 31a side skew section 31a13 As the direction center section of a path serves as a ridgeline, the end side (outer layer side) of the direction of a path is bent 180 degrees of abbreviation at an other end side (inner layer side), and, thereby, direction length of path c of the skew section 31a13 has become half [of direction length of path a of inner conductor section 31c]. On the other hand, the outer layer side

inserted in the 1st slot, in the first coil of a conductor, and the 31a side skew section 31a14, as the direction center section of a path serves as a ridgeline, the inner layer side of the direction of a path is bent at an outer layer side, and, thereby, direction length of path c of the skew section 31a14 has become half [of direction length of path a of inner conductor section 31c]. And these skew sections 31a13 and 31a14 are piled up in the direction of a path in the point 31a16, and are joined by soldering, welding, etc.

[0074] According to this operation form, while the same effect as the fifth operation form is acquired, the skew section 31a13 and direction length of path c of 31a14 are made to abbreviation half, with the same cross section as inner conductor section 31c held.

[0075] In addition, other conductors connected in the said layers can be made the same composition as the 100th above-mentioned slot and the conductor arranged at the 1st slot.

(The seventh operation form) Drawing 17 shows the seventh operation form and the concrete composition for making small the direction length of a path of the coil end connected in the said layers differs from the fifth operation form.

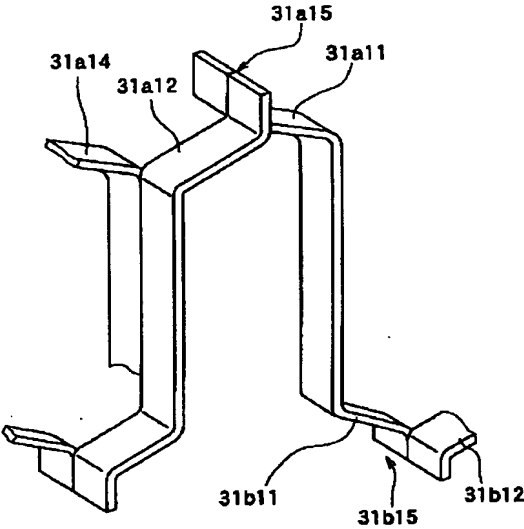
[0076] Drawing 17 the outer layer side which shows the conductor arranged at the 100th slot and the 1st slot, and was inserted in the 100th slot the first coil of a conductor and the 31a side skew section 31a13. It applies at the nose of cam of the skew section 31a13 from the mid-position (however, position near inner conductor section 31c) of this skew section 31a13, is twisted 90 degrees of abbreviation, and the field which follows the hoop-direction side 31c1 of inner conductor section 31c turns to the direction of a path. On the other hand, the outer layer side inserted in the 1st slot, it is twisted 90 degrees of abbreviation, 31a side skew applying [the first coil of a conductor, and / 31a14] them at the nose of cam of the skew section 31a14 from the mid-position of this skew section 31a14, and the field which follows the hoop-direction side 31c1 of inner conductor section 31c turns to the direction of a path. And the field which follows the hoop-direction side 31c1 of inner conductor section 31c in the point 31a16 piles up these skew sections 31a13 and 31a14 in the direction of a path, and they are joined by soldering, welding, etc.

[0077] According to this operation form, while the same effect as the fifth operation form is acquired, the skew section 31a13 and the direction length of a path of 31a14 can be made small, with the same cross section as inner conductor section 31c held. Here, if direction length of path a of inner conductor section 31c is carried out more than the two times of hoop-direction length b of inner conductor section 31c, the skew section 31a13 and the direction length of a path of 31a14 can be made below into the half of direction length of path a of inner conductor section 31c. Therefore, when the oblateness of a conductor is high, especially this operation form is effective.

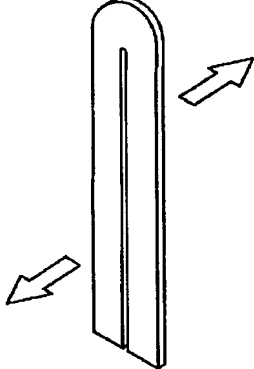
[0078] In addition, other conductors connected in the said layers can be made the same composition as the 100th above-mentioned slot and the conductor arranged at the 1st slot.

The conductor fabricates only the skew section of one coil end in the predetermined configuration. (others -- operation form) a segment -- After inserting from opening of the shaft orientations of a slot, may fabricate the skew section of the coil end of another side, and Or the coil end of both sides is beforehand fabricated in the predetermined configuration, a conductor is inserted from opening by the side of the inner circumference of a slot, plastic working may be carried out and the conductor within a slot may be fixed so that this opening may be narrowed after that. in addition, the case of the latter -- a segment -- not a conductor but continuation -- a conductor can also be used in this case, each segment - since the junction process of a conductor becomes almost unnecessary, reduction of a large attachment man day is attained

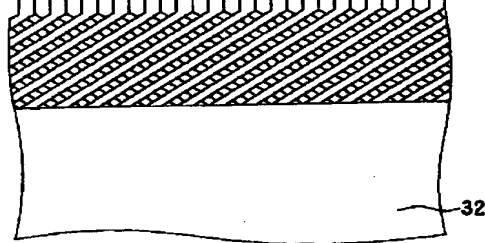
[Translation done.]



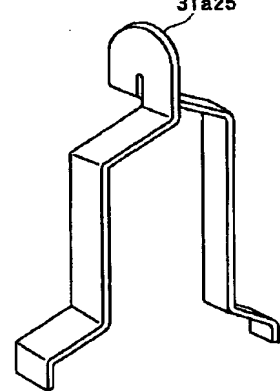
[Drawing 5]



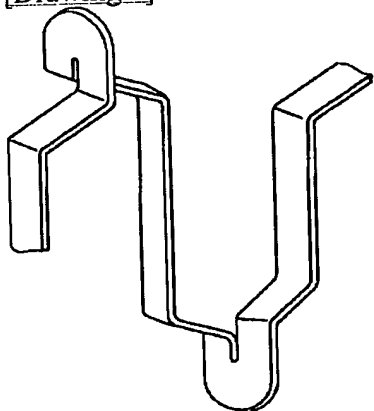
[Drawing 4]



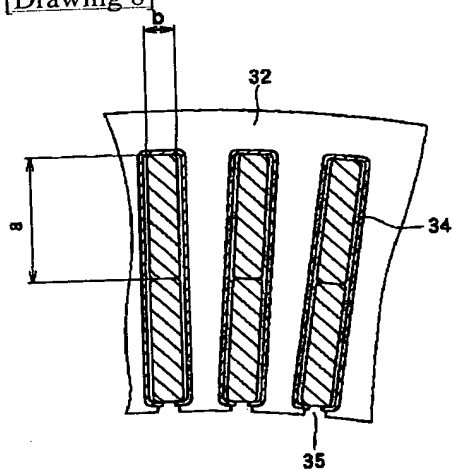
[Drawing 6]



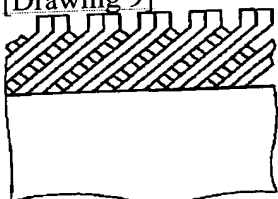
[Drawing 7]



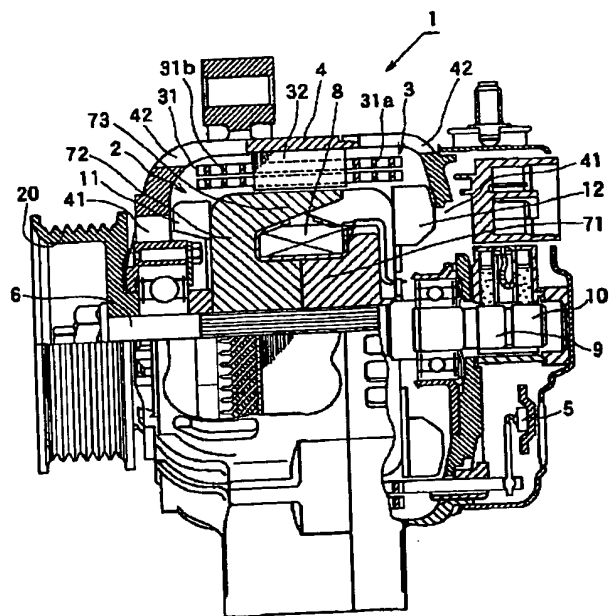
[Drawing 8]



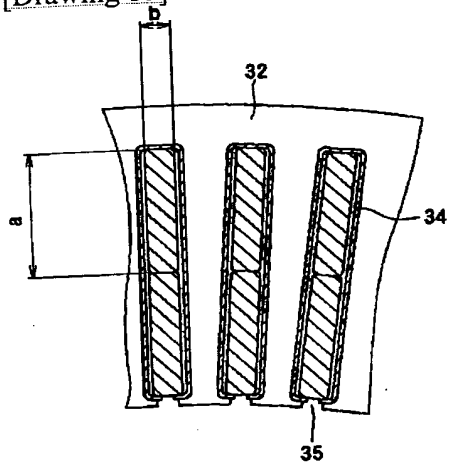
[Drawing 9]



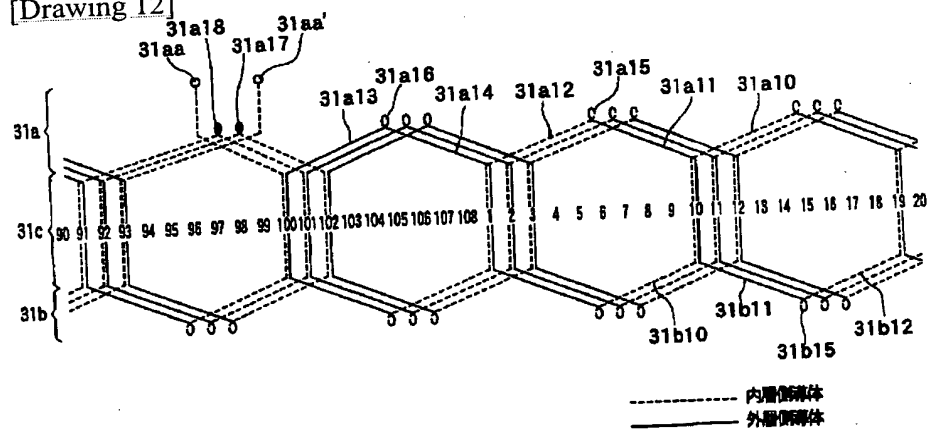
[Drawing 10]



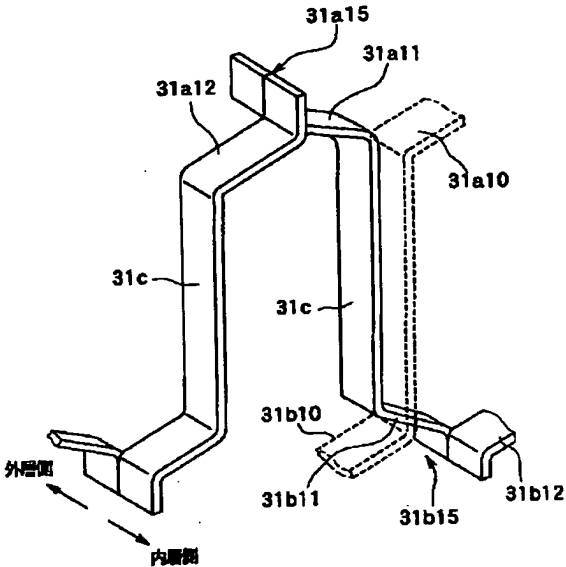
[Drawing 11]



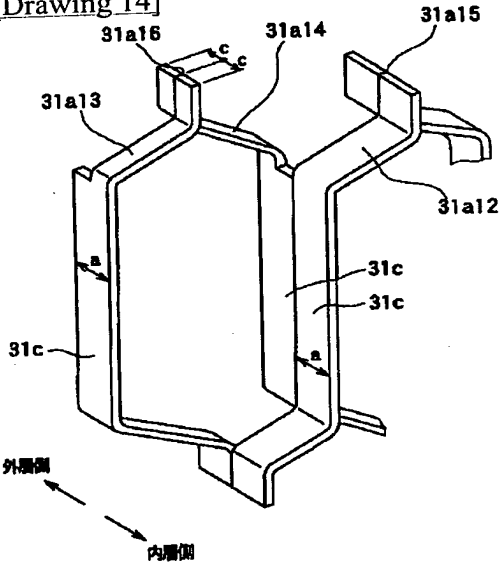
[Drawing 12]



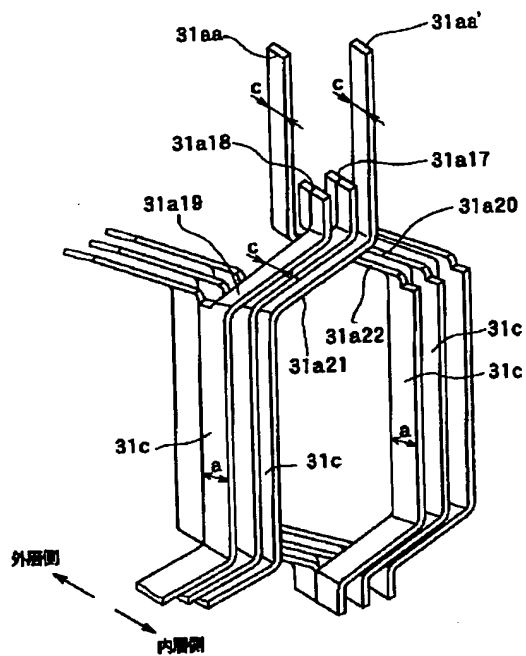
[Drawing 13]



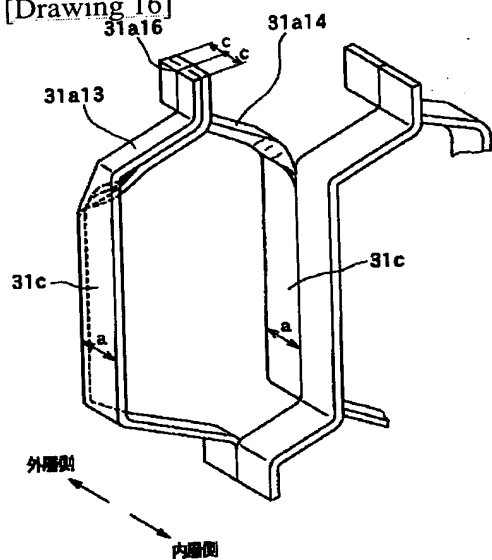
[Drawing 14]



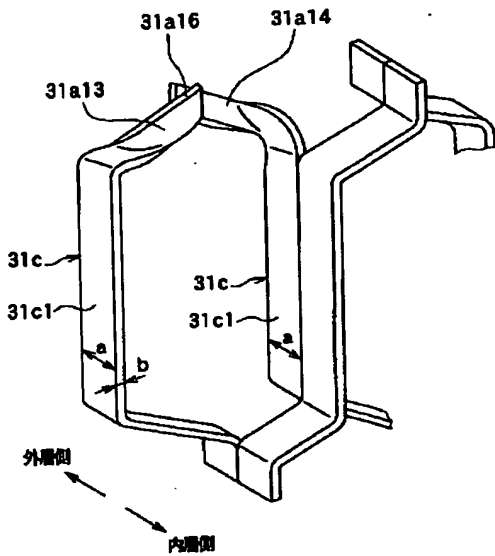
[Drawing 15]



[Drawing 16]



[Drawing 17]



[Translation done.]